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THE PRODUCTION AND THE FISHING METHODS OF THE MAINE HERRING INDUSTRY with notes on the 1947 season

SPECIAL SCIENTIFIC REPORT 67

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Explanatory Note

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Albert M. Day, Director

Special Scientific Report No. 67

THE PRODUCTION AND THE FISHING METHODS OF THE MAINE HERRING INDUSTRY WITH NOTES ON THE 1947 SEASON

by

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INTRODUCTION

In 1947, the Maine Sardine Packer's Association requested that the United States Fish and Wildlife Service begin a study of the herring fishery of Maine. To carry on this work, the Association provided the sum of $6,000 for the fiscal year 1948. Of this money, $4,500 was made available to the Treasury of the United States and thus to the Fish and Wildlife Service. For the payment of salary and partial traveling expenses of a biological aid who was to work under the supervision of the Fish and Wildlife Service, the association set aside $1,500. The Maine Department of Sea and Shore Fisheries also had a share in the investigation by paying part of the expenses of the biological aid. This investigation was effected under a contract signed by the three groups concerned and this paper thus represents part of the results of the joint efforts.

In the performance of the field work, John C. Pearson, Louis D. Stringer and John R. Webster, biologists of the Service, collaborated for varying lengths of time. Douglass C. Pennoyer, employed as a biological aid by the Association, was also engaged actively in this investigation.

As it will be of greatest interest to those engaged in the sardine industry or the herring fishery, this report has been designed as a non-technical account.

THE FISHERY

On the North Atlantic coast of North America, the herring, Clupea harengus, occurs between Chesapeake Bay and northern Labrador. It appears to be most abundant in the waters between Cape Cod and Newfoundland. In this area, which includes the Gulf of Maine and the Gulf of St. Lawrence, the herring is the object of an organized fishery. Elsewhere in its range, this species is caught incidentally with other fish. A herring fishery is profitable only where the herring are very abundant, for this species, in comparison with other fish, has a low value. Consequently, the herring fishery is carried on in those regions noted for their available supplies of these fish. Such areas are the coasts of Maine, New Brunswick, Nova Scotia, Newfoundland and the Magdalen Isles. Herring may be intermittently abundant throughout the years along the shores between New Hampshire and New Jersey, but relatively few are caught and utilized.

In the United States, the greatest yield of Atlantic herring is realized in the State of Maine. During the period 1924 - 1944, Maine's annual catch of herring for the 15 years in which statistics were collected by the United States Bureau of Fisheries and its successor, the

United States Fish and Wildlife Service, averaged over 57,852,000 pounds. In the same period, an average of 5,997,000 pounds was taken in Massachusetts; 363,000 pounds, in Rhode Island; and less than 5,000 pounds in Connecticut and New Hampshire. During the period 1926 - 1944 14 annual censuses of fishery production in the Middle Atlantic section of the United States indicate that New York's herring catch averaged about 39,000 pounds and that of New Jersey was about 935,000 pounds. Because Maine produces such a large share of the U. S. herring catch any discussion of this fishery will be concerned primarily with that State. Table 1 shows the catch of Atlantic herring in the above States during recent years from information collected by the U. S. Bureau of Fisheries and the U. S. Fish and Wildlife Service. Figure 1 shows the Maine catch for years in which statistics were collected by the Government agencies.

The size of the catch is greatly influenced by economic conditions and therefore the herring catch figures are not an adequate measure of either the abundance or availability of this fish. As a rule, the catch indicates the strength of the demand for herring products. When the market is weak, the processors hesitate to prepare a quantity of herring which may become a surplus and further depress the market. As a result, many fishermen are discouraged by their frequent inability to dispose of their catches and consequently turn their attention to more profitable fisheries. Occasionally, as during the period 1941-1947, the market may absorb all the herring which can be caught and processed. During some of the last eight years, because of war conditions, the production of herring was somewhat limited at times by an inadequate supply of labor in the sardine canneries, and there was an occasional slowing down of fishing until the canneries could absorb the catches. As the great bulk of the herring catch is now used as sardines, the operating capacity of the canneries may limit the amounts of herring which can be utilized. In 1947 the market was strong; the canneries' facilities and help adequate; and the limiting factor was the availability of the fish. An average of about 2,800,000 cases of sardines was packed in 1941-1947; this was about double the 1928-1940 average. Table 2 and Figure 2 show the pack of sardines between 1928 and 1947, as collected by the U. S. Bureau of Fisheries and the U. S. Fish and Wildlife Service.

For the past several years the sardine industry has been engaged in a construction program to modernize and expand the existing facilities. Also, the number of canneries in operation is increasing as can be seen in Table 3 and Figure 3. Data on the enlarged capacities of the older canneries are not available. A somewhat similar construction program is being carried on in Canada along the southern New Brunswick coast, an area which furnishes a large supply of fish for the eastern Maine canneries. This expansion of the sardine canning industry has been brought

TABLE 1. Atlantic Herring Catch in Certain States
(in thousands of pounds)

Year	Maine	New Hampshire	Massachusetts	Rhode Island	Connecticut	New York	New Jersey
1943	57,190	—	2,930	24	4	145	2,186
1942	93,997	—	5,647	32	—	2/	1,957
1940	38,016	—	5,899	135	1	36	1,889
1939	69,603	—	5,540	45	2/	41	1,246
1938	16,055	—	4,881	111	—	14	1,161
1937	49,952	—	2,894	196	—	5	366
1935	50,943	—	3,190	196	—	75	259
1933	43,775	—	3,573	737	—	75	590
1932	31,988	—	5,687	399	—	24	615
1931	55,785	—	7,879	235	—	47	456
1930	73,939	60	8,687	215	—	32	660
1929	91,860	—	12,998	2,364	—	15	41
1928	64,685	—	5,646	221	—	1/	1/
1926	1/	1/	1/	1/	1	2	236
1924	47,838	—	13,180	507	2/	1/	1/

1/ No census in that year.

2/ Less than 1,000 pounds.

TABLE 2. Pack of Canned Sardines (Atlantic Herring)

Year	Cases in thousands 1/	Value in thousands	Year	Cases in thousands 1/	Value in thousands
	No.	Dollars		No.	Dollars
1947	2,753	27,530 2/	1933	981	2,397
1946	3,019	19,549	1932	546	1,370
1945	2,514	11,520	1931	885	2,647
1944	3,036	14,224	1930	1,399	4,459
1943	2,353	10,686	1929	2,026	6,898
1942	2,720	11,692	1928	2,056	8,077
1941	3,131	12,476	1927	1,262	5,249
1940	1,118	3,736	1926	1,718	6,727
1939	2,210	7,075	1925	1,871	6,716
1938	672	2,367	1924	1,900	7,191
1937	1,680	4,998	1923	1,272	5,289
1936	1,846	5,740	1922	1,870	5,750
1935	1,656	5,143	1921	1,400	3,961
1934	1,143	3,315			

1/ These are "standard cases", which represent the various-sized cases converted to the uniform basis of one hundred 1/4 pound cans. (3¼ ounces net.)

2/ Estimated.

TABLE 3. Number of North Atlantic Sardine Plants

Year	Plants	Year	Plants
	No.		No.
1948	44 1/	1935	22
1947	36	1934	22
1946	31	1933	23
1945	28	1932	13
1944	28	1931	27
1943	29	1930	33
1942	27	1929	37
1941	29	1928	38
1940	27	1927	37
1939	27	1926	35
1938	25	1925	31
1937	25	1924	28
1936	24	1923	28

1/ Preliminary data.

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about by the operators' desire to have an increasing share of the prosperity which has been realized by this business since 1941. In pre-war years, the demand for North Atlantic sardines would absorb about 2,000,000 or less cases per year. During the war the Government purchases enabled the industry to increase the yearly pack to around 3,000,000 cases. Although Government purchases have dropped to negligible amounts during the past few years, there has been an increased domestic demand for Maine sardines. The diminished competition from the California sardine, the pack of which has been a great deal below normal for several seasons, is largely responsible for the increased sale of the Atlantic sardines.

In 1938 and 1940 there was a scarcity of herring on the fishing grounds and the low catch indicated this condition. Undoubtedly there have been other years when the fish were not available in sufficient quantities to satisfy the demand, but no records of such lean years are readily obtained. In such years as 1938 and 1940, there is no evidence that the abundance of the herring was low, although such could have been true. However, the fish may not have visited the customary inshore fishing grounds and, therefore, not have been caught.

GEAR EMPLOYED

In the pursuit of those species for which the demand has greatly increased, the fisheries have almost invariably augmented their production by either extending their fishing operations over larger areas or by developing more efficient types of gear. During the past 50 years or so, the consumption of herring has not greatly increased and therefore there has been no need for greater production. In other fisheries the introduction of the internal combustion engine permitted more distant grounds to be actively harvested, but, in general, the coastal areas of the North Atlantic have been producing enough herring to fill the needs of the sardine canneries and other herring processors. Increasing quantities of Canadian herring have been imported in recent years, as shown in Table 4 and Figure 4, but there is not much possibility of obtaining, with present fishing gear, greater catches from Bay of Fundy areas. However, if it were necessary to increase the production of herring above its present level, the possibility of finding new and more distant fishing grounds or the use of improved fishing gear would have to be considered.

There have been some improvements in the types of gear employed to catch the Atlantic herring. The evolution of the gear is not yet completed. More efficient types than those used in New England are now in operation in the herring fisheries of Europe and the North Pacific.

TABLE 4. Imports of Fresh Sea Herring 1/

Year	Thousands of pounds	Year	Thousands of pounds
1947	78,636 2/	1933	23,899
1946	92,251	1932	10,864
1945	59,265	1931	13,238
1944	72,737	1930	27,163
1943	76,589	1929	36,601
1942	57,152	1928	54,331
1941	64,238	1927	16,960
1940	20,635	1926	46,253
1939	30,506	1925	16,335
1938	11,629	1924	19,064
1937	24,617	1923	12,548
1936	47,352	1922	9,751
1935	37,459	1921	6,951
1934	36,118		

1/ From data supplied by the Bureau of Customs, U. S. Department of Commerce.

2/ Preliminary.

For detailed discussions of the early history of the herring fishery, with emphasis on the methods of catching and processing the fish, we recommend that the publications by Earll (1887), Hall (1898), and Moore (1898) be examined. Much of the following has been abstracted from their works.

As with most fisheries, the methods of capturing herring have evolved from rather crude, simple gear to more complex apparatus. One of the first ways of catching herring was "Torching". This was carried on from a rowboat which carried a torch on its bow. One fisherman rowed the boat and the other stood in the stern with a dip net. As the boat passed over a school of fish the herring were attracted by the light, rose to the surface, and were dipped out of the water. "Torching" required a great deal of manual effort and, for the amount of effort expended the quantities of herring caught were relatively small compared with those taken by other types of gear. This method is occasionally used by lobster fishermen to secure small amounts of herring for bait, but the total quantities now taken by this gear are relatively insignificant.

While the Indians of the eastern North Atlantic coast are known to have used brush weirs before the arrival of the early colonists, this type of stationary gear was not built in Maine until about 1820. The first weirs were rather simple structures of wooden stakes and brush, erected in shallow water in regions where herring were known to be plentiful. Larger, more complex weirs in deeper water were evolved later. The principle and the design of the weir are similar to those of the pound net or trap-net. Schools of fish encounter the "leaders" (fence-like structures of brush or netting), which extend out from the "pocket" (an enclosure of brush or netting). As the leaders block the route of the school the fish must change their direction and may follow a leader into the pocket from which they are unable to escape easily. During the 1947 season 132 weirs accounted for slightly under one-third of the Maine catch. The few floating traps in Cumberland County had little or no catch of herring. According to the fragmentary statistical records of the fishery, weirs and floating traps produced about 85 percent of the catch between 1887 and 1919. Between 1924 and 1930 about 51 percent of the Maine herring was caught by these gears, and between 1931 and 1944, slightly over 46 percent. In New Brunswick, Canada, weirs are still the dominant gear.

Mr. Oscar A. Rigby, Senior Inspector of the Canadian Department of Fisheries, kindly supplied us with a list of the weirs in his district of New Brunswick, which includes Charlotte, St. John, and Albert Counties and the Bay of Fundy section of Westmoreland County. Of 625 weir sites in 1947 there were 347 weirs which were to be in operation. Of this number 327 were in Charlotte County; 18 in St. John County; and 2 in Albert and Westmoreland Counties. Complete figures on the numbers of weirs actively fishing were not available when we requested the information in the early summer; therefore, the numbers of weirs actually in operation may differ slightly from the above.

Gill nets were employed in the herring fishery a few years after the first weirs were built. The nets, which were suspended at various depths between the surface of the water and the bottom, were provided with buoys and anchors. The size of the mesh varied from two to three inches and thus only the large herring were caught. Between 1887 and 1898, gill nets took about 16 percent of the herring. Since the first World War the use of this gear in the Maine herring fishery has been of extremely minor importance. In the Canadian Maritime Provinces gill nets are still utilized to catch the larger fish, primarily during the spawning season.

The stop seine, or haul seine as it is sometimes called, is now the dominant type of gear in Maine. Over 60 percent of the herring were taken by this apparatus in 1947. In the statistics collected prior to 1947 herring caught by stop seines and purse seines were occasionally grouped together. It is necessary in now examining the past statistics to consider the catch by "seines" and not attempt to segregate the

amounts caught by purse seines and stop seines. Prior to the First World War seines caught ordinarily less than 10 percent of the Maine herring production. Between 1924 and 1930 they accounted for 49 percent, and from 1931 to 1944, slightly under 56 percent.

The stop seine is a small-mesh net used to prevent the exit of a herring school from a cove or inlet of the sea. Fishermen using this gear are most active at night, visiting various coves to see if herring are present, and sometimes following herring schools until they enter an inlet where they can be entrapped. Presence of the fish is usually detected by the "firing" of the water, caused by the herring disturbing the phosphorescent life of the sea. Often the fish can be heard flipping near the surface of the water and this sound sometimes reveals the whereabouts of a school. The seine is stretched around the school with the ends of the net being made fast to the shore. Once enclosed by this net the school can be concentrated later, by the use of more seines, into a dense mass of fish. The fish can then be held until removed by dip nets and dumped into the hold of the boat which carries the fish to the cannery. Stop seines are sometimes used by weirmen to prevent the movement of fish away from the weir locality. During 1947 a total of 55 stop seine crews were engaged in the Maine fishery. The stop seine fishery is essentially a small boat operation. Most of the boats are under 50 feet long and the nets are carried in and set from dories.

The purse seine, although used by the mackerel fishermen since a few years after the Civil War, has not been commonly employed in the northwestern Atlantic herring fishery. The purse seine differs from the stop seine in two respects. First, the net is manipulated entirely from boats with the ends of the nets not attached to shore, and second, the net has a series of purse rings through which a line runs and by which the bottom of the net can be closed. During the first World War an increased demand for herring and the subsequent increase in price to the fishermen induced purse seiners to catch quantities of the large herring. Schools of these big fish appear just before, during, and following the spawning season and are most easily caught then. The principal grounds for purse seiners during 1917-19 was the area around Monhegan Island off the Maine coast. With the cessation of the war the demand for the large herring declined and there was little market for the purse seine fish. One disadvantage of offshore purse seining for small fish would be that it is difficult to hold the fish until the "red feed" is cleared from the digestive tract. "Red feed" is one of the principal foods of the sardine herring and consists of small red crustaceans, sometimes known as copepods. Herring which recently have been eating these crustaceans cannot be removed from the water and transported to the cannery until most of the feed has been voided from their intestinal tracts. Failure to allow the fish time to digest and evacuate the feed results in a rapid decomposition of

the herring after it has died. The large fish caught near the spawning time usually do not have the red feed and consequently can be taken aboard the boat immediately after being caught. During the period 1941 to 1947, purse seiners were again active along the coast of Maine and caught large quantities of fish in the waters near Monhegan Island. A purse seine fishery for the sardine herring began during the second World War in the waters of the Bay of Fundy and along the eastern coast of Maine, principally in Machias Bay.

While the purse seine for large herring is usually used to catch fish in waters deeper than the depth of the net the purse seine for the smaller herring is used in shallow bays where the leads of the net reach the bottom. Thus the small herring purse seine, if handled properly, prevents the easy escape of the fish out of the bottom of the net. The large herring purse seine, on the other hand, must have its purse line quickly drawn or the fish may escape from the net into greater depths. Both types of gear are not large compared to the ones used in Alaska or Europe where a net of 40 fathoms depth is not unusual. The Maine and New Brunswick purse seiners use nets about 15 or 20 fathoms deep.

Detection of schools of large herring is effected largely by observation of the "firing" of the water during the night. The main season for the big fish off Monhegan Island is October and November. Purse seiners locate the schools of small herring either by bottom echo-sounding apparatus or by the use of a thin wire suspended in the water. The latter indicates the presence of herring by transmitting to the fisherman the vibrations of the wire when a fish strikes it. The purse seines for small herring are used almost entirely during the winter months when the water is cold. The schools then are reported by the fishermen to be relatively sluggish in movement and the red feed is not common in the alimentary tract of the herring. In 1947, eleven purse seiners were active in the fall fishery for Maine herring. How many engaged in the New Brunswick and Maine winter fishery is not definitely known yet.

It is not remarkable that the Maine weir fishery has declined and the seine fishery has increased in importance. The weir is a stationary type of gear and is dependent entirely upon the movement of herring schools into the weir itself. Thus, herring may be abundant in a particular locality, but fail to enter a nearby weir. On the other hand, the seiner covers extensive areas in search of fish and, if the herring are abundant, he has a much better chance of making a catch than the weir operator. Therefore, the seine represents a much more efficient and consequently more profitable type of gear.

Another possible means of capturing herring is by use of the otter trawl. In Europe it has been demonstrated for many years that herring,

when concentrated near the bottom, can be caught in large quantities with otter trawls. Recently this type of gear has been successful in catching small herring in British Columbia, Canada. Tester (1948) reported the landing of 330 tons in several weeks of experimental fishing by 5 trawlers during February 1948. The presence of herring schools there was determined by echo-sounding apparatus. Whether or not this gear would be applicable to the northwestern Atlantic region is not known. There seems to be no apparent reason why it could not be used to advantage in some sections during the winter months.

NEED FOR ADEQUATE STATISTICS

A study of marine fish populations has to depend upon inductive evaluations of the abundance, for it is obviously impossible to know the exact size of the populations. In the case of the Atlantic herring our most valuable data on the stocks of fish can be obtained from analysis of the catches made by the various types of fishing gear in various areas throughout the season. The first step in an investigation of this nature concerns the establishment of a system by which data pertinent to future abundance or availability analyses can be collected. Once established such a statistical system can continue through the years with a minimum of effort.

Statistics of the herring fishery are collected monthly by agents of the U. S. Fish and Wildlife Service and the Maine Department of Sea and Shore Fisheries, but we found that, for our purposes, such data were not entirely satisfactory. Under the statistical system now in operation on a cooperative basis by the two above agencies, State fishery wardens collect the herring production figures directly from the fishermen. With present conditions such statistics have several disadvantages. They are difficult to keep on a current basis for the wardens are not able to interview each fisherman each month. Also, the geographical locations of the catches are usually recorded as the home ports of the fishermen. Thus, the statistics now available may err both seasonally and geographically.

THE 1947 SEASON, JUNE--DECEMBER

During the season, June to December 1947, we collected data on the daily landings of herring from all the Maine sardine canneries, 11 herring smokers, 7 canners of large herring, 3 fish meal plants, 2 freezing establishments, 2 pickling plants, and 1 trucking concern. Information was not available from two trucking companies, but their purchases were not much more than 500,000 pounds for the season. For each delivery of herring to the concerns interviewed the following information is available: Name of purchaser, date of delivery, fisherman's

name, type of gear employed, locality of capture, and quantity of fish. Such data will be ultimately transferred to punch cards or other sorting cards for ease in analysis. At the present time the data allow us to show easily the relative importance of various areas in the catch and of the type of gear employed and the seasonal variation in the catch. Table 5 gives the information revealed by the tabulation of these data.

Although Table 5 represents perhaps the first time that the herring catch has been broken down on a seasonal basis, it is not entirely complete. Herring used for lobster bait are not included. Although the carcasses of rosefish (Sebastes marinus), also known locally as redfish, bream, and sea perch, are used almost exclusively for lobster bait in the western part of the Maine coast from Rockland to Kittery, the utilization of herring for bait increases to the eastward. In Washington County, bait other than herring is not often considered. Further information on this use of herring must be obtained if we are to have a complete picture of the catch of the fishery.

ESTABLISHMENT AND ANALYSIS OF STATISTICAL AREAS

In order to study more closely the fluctuations of both the fungus infection and the catch, we have found it expedient to divide the New Brunswick and Maine coastal herring fishing grounds into smaller areas. These areas represent approximately equal portions of the coast and the boundaries have been established so that, as far as it has been possible to do so, the areas so determined are natural fishing grounds. As the catch data have been collected so that the exact location of each catch has been indicated, the boundaries can be changed and different areas designated, if such should become advantageous in future studies.

Areas I - IV

These four areas were originally established to divide the New Brunswick herring grounds into smaller geographical areas. It was found somewhat difficult to allocate to their proper areas the landings of Canadian fish as reported by the boatmen to the American canneries. Consequently, no analysis of the Canadian production of herring was attempted from the data possessed.

Through the courtesy of Mr. Oscar A. Rigby we were able to secure the monthly landings of herring in Charlotte and St. John Counties, New Brunswick. These two counties provide the bulk of the imported herring used by the Maine sardine canneries. These data appear in Table 6.

TABLE 5. MAINE HERRING PRODUCTION, JUNE-DECEMBER, 1947
(In bushels) 1/

Week ending	Area V			Area VI			Area VII		
	Weir	Stop Seine	Total	Weir	Stop Seine	Total	Weir	Stop Seine	Total
6/7	—	—	—	—	—	—	—	—	—
6/14	280	—	280	—	—	—	—	—	—
6/21	79	—	79	—	—	—	—	—	—
6/28	2,846	—	2,846	2,589	—	2,589	300	—	300
7/5	1,304	—	1,304	158	—	158	648	—	648
7/12	1,925	—	1,925	1,523	—	1,523	458	—	458
7/19	464	—	464	5,224	—	5,224	2,249	700	2,949
7/26	2,888	—	2,888	7,415	1,819	9,234	4,421	1,453	5,874
8/2	787	—	787	9,877	1,085	10,962	4,379	3,550	7,929
8/9	2,950	—	2,950	2,345	—	2,345	5,414	9,021	14,435
8/16	3,825	—	3,825	2,845	—	2,845	3,384	3,062	6,446
8/23	6,396	700	7,096	7,413	1,382	8,795	7,063	5,686	12,749
8/30	3,869	—	3,869	9,354	525	9,879	8,975	15,736	24,711
9/6	7,192	—	7,192	2,870	—	2,870	5,212	14,045	19,257
9/13	3,358	—	3,358	3,245	—	3,245	4,371	16,430	20,801
9/20	7,612	—	7,612	6,209	—	6,209	2,621	1,811	4,432
9/27	2,552	—	2,552	6,509	490	6,999	8,780	3,798	12,578
10/4	9,511	—	9,511	10,249	875	11,124	403	—	403
10/11	7,525	—	7,525	8,749	—	8,749	472	—	472
10/18	5,845	—	5,845	23,252	1,294	24,546	—	—	—
10/25	1,217	8,540	9,757	15,969	—	15,969	1,837	3,798	5,635
11/1	4,884	1,120	6,004	11,223	—	11,223	1,660	—	1,660
11/8	1,243	61	1,304	10,084	—	10,084	2,303	490	2,793
11/15	—	—	—	8,530	—	8,530	44	—	44
11/22	—	263	263	10,077	5,660	15,737	1,303	2,520	3,823
11/29	—	—	—	8,410	1,208	9,618	525	—	525
12/6	—	—	—	3,359	350	3,709	1,243	3,289	4,532
12/13	—	—	—	—	—	—	998	3,046	4,044
Total	78,552	10,684	89,236	177,478	14,688	192,166	69,063	88,435	157,498

1/ A bushel weighs 70 pounds.

MAINE HERRING PRODUCTION, JUNE-DECEMBER, 1947
(In bushels)

Week ending	Area VIII			Area IX			Area X		
	Weir	Stop Seine	Total	Weir	Stop Seine	Total	Weir	Stop Seine	Total
6/7	—	—	—	—	—	—	—	—	—
6/14	—	—	—	—	—	—	—	—	—
6/21	—	—	—	—	—	—	—	—	—
6/28	—	—	—	—	3,004	3,004	884	—	884
7/5	—	—	—	95	1,700	1,795	1,800	—	1,800
7/12	2,963	—	2,963	2,827	—	2,827	1,543	—	1,543
7/19	16,736	—	16,736	150	7,234	7,384	3,729	4,063	7,792
7/26	5,323	—	5,323	1,412	5,540	6,952	2,238	4,326	6,564
8/2	8,741	5,222	13,963	487	6,319	6,806	1,484	10,473	11,957
8/9	5,293	11,489	16,782	1,388	10,461	11,849	678	8,780	9,458
8/16	1,623	4,253	5,876	704	24,619	25,323	533	14,801	15,334
8/23	5,473	2,433	7,906	1,130	11,413	12,543	934	24,513	25,447
8/30	9,443	2,853	12,296	2,611	5,816	8,427	69	6,947	7,016
9/6	2,786	—	2,786	425	—	425	1,200	13,094	14,294
9/13	4,325	—	4,325	3,932	—	3,932	408	34,211	34,619
9/20	7,586	—	7,586	575	—	575	630	20,037	20,667
9/27	612	—	612	560	—	560	1,305	4,372	5,677
10/4	1,409	—	1,409	—	—	—	—	11,717	11,717
10/11	236	—	236	—	3,190	3,190	—	4,862	4,862
10/18	997	—	997	700	280	980	541	17,144	17,685
10/25	—	—	—	446	4,678	5,124	—	5,022	5,022
11/1	604	—	604	980	—	980	—	1,279	1,279
11/8	367	—	367	53	—	53	—	—	—
11/15	—	—	—	—	—	—	—	—	—
11/22	—	—	—	—	—	—	—	—	—
11/29	—	—	—	—	—	—	—	—	—
12/6	—	—	—	—	—	—	—	—	—
12/13	—	—	—	—	—	—	—	—	—
Total	74,517	26,250	100,767	18,475	84,254	102,729	17,976	185,641	203,617

MAINE HERRING PRODUCTION, JUNE-DECEMBER, 1947
(In bushels)

Week ending	Area XI			Area XII			Area XIII		
	Weir	Stop Seine	Total	Weir	Stop Seine	Total	Weir	Stop Seine	Total
6/7	—	—	—	—	—	—	—	—	—
6/14	—	—	—	—	—	—	—	—	—
6/21	510	—	510	—	—	—	—	474	474
6/28	2,626	—	2,626	—	—	—	—	6,168	6,168
7/5	1,955	—	1,955	1,545	—	1,545	675	800	1,475
7/12	2,532	—	2,532	2,875	—	2,875	—	350	350
7/19	1,851	—	1,851	1,730	—	1,730	3,175	—	3,175
7/26	3,129	—	3,129	5,290	—	5,290	1,822	825	2,647
8/2	3,008	1,200	4,208	1,789	—	1,789	—	2,725	2,725
8/9	2,121	—	2,121	1,486	—	1,486	280	4,532	4,812
8/16	500	—	500	547	—	547	—	5,885	5,885
8/23	531	—	531	642	—	642	—	6,455	6,455
8/30	3,589	—	3,589	641	—	641	—	—	—
9/6	3,788	—	3,788	475	—	475	625	3,950	4,575
9/13	400	—	400	850	—	850	350	2,250	2,600
9/20	1,297	—	1,297	400	—	400	—	2,950	2,950
9/27	2,310	650	2,960	600	—	600	—	—	—
10/4	526	400	926	225	—	225	—	—	—
10/11	—	—	—	250	—	250	800	—	800
10/18	—	—	—	—	—	—	—	—	—
10/25	—	—	—	—	—	—	—	—	—
11/1	—	—	—	—	—	—	—	—	—
11/8	—	—	—	—	—	—	—	—	—
11/15	—	—	—	—	—	—	—	—	—
11/22	—	—	—	—	—	—	—	—	—
11/29	—	—	—	—	—	—	—	—	—
12/6	—	—	—	—	—	—	—	—	—
12/13	—	—	—	—	—	—	—	—	—
Total	30,673	2,250	32,923	19,345	--	19,345	7,727	37,364	45,091

MAINE HERRING PRODUCTION, JUNE-DECEMBER, 1947
(In bushels)

Week ending	Area XIV				Area XV			Area XVI		
	Weir	Purse Seine	Stop Seine	Total	Purse Seine	Stop Seine	Total	Purse Seine	Stop Seine	Total
6/7	--	--	--	--	--	--	--	--	--	--
6/14	--	--	--	--	--	--	--	--	--	--
6/21	--	--	--	--	--	--	--	--	2,806	2,806
6/28	--	--	1,920	1,920	501	4,107	4,107	--	2,607	2,607
7/5	--	--	1,230	1,230	--	1,050	1,551	--	13,624	13,624
7/12	--	384	1,201	1,585	681	3,408	3,408	--	16,667	16,667
7/19	318	437	--	755	495	--	681	--	19,289	19,289
7/26	758	1,404	3,727	5,889	--	1,150	1,645	--	10,076	10,076
8/2	786	1,254	7,193	9,233	45	650	650	--	8,401	8,401
8/9	--	--	2,335	2,335	462	1,800	1,845	--	3,502	3,502
8/16	267	--	10,563	10,830	--	--	462	--	10,223	10,223
8/23	--	1,398	1,935	3,333	243	1,440	--	--	1,177	1,177
8/30	--	--	1,850	1,850	--	3,090	1,683	--	1,179	1,179
9/6	--	--	--	--	--	2,225	3,090	--	1,035	1,035
9/13	--	--	850	850	609	6,097	2,225	--	2,200	2,200
9/20	1,305	--	3,000	4,305	2,754	6,975	6,706	--	--	--
9/27	--	--	--	--	243	4,669	9,729	--	1,985	1,985
10/4	--	--	--	--	1,422	20,075	4,912	--	1,043	1,043
10/11	550	--	3,287	3,837	6,144	21,435	21,497	200	7,739	7,939
10/18	--	--	8,309	8,309	10,255	31,750	27,579	--	12,569	12,569
10/25	--	--	7,442	7,442	10,980	14,385	42,005	1,550	11,621	13,171
11/1	--	--	--	--	4,574	3,985	25,365	800	7,858	8,658
11/8	--	--	--	--	5,289	1,465	8,559	--	858	858
11/15	--	--	--	--	--	--	6,754	18,165	2,810	20,975
11/22	--	--	--	--	--	8,633	--	4,098	900	4,998
11/29	--	--	--	--	--	900	8,633	11,712	310	12,022
12/6	--	--	--	--	--	--	900	--	--	--
12/13	--	--	--	--	--	--	--	--	--	--
Total	3,984	4,877	54,842	63,703	44,697	139,289	183,986	36,525	140,479	177,004

MAINE HERRING PRODUCTION, JUNE-DECEMBER, 1947
(In bushels)

Area XVII			Total by Gear			
Week ending	Stop Seine	Total	Weir	Stop Seine	Purse Seine	Grand Total
6/7	72	72	—	72	—	72
6/14	1,300	1,300	280	4,106	—	4,386
6/21	—	—	589	7,188	—	7,777
6/28	2,875	2,875	7,620	30,266	501	38,387
7/5	2,500	2,500	8,180	26,305	—	34,485
7/12	6,115	6,115	16,646	26,955	1,065	44,666
7/19	20,430	20,430	35,626	43,653	932	80,211
7/26	23,237	23,237	34,696	49,978	1,404	86,078
8/2	26,513	26,513	31,338	69,582	1,299	102,219
8/9	17,617	17,617	21,955	74,458	462	96,875
8/16	15,679	15,679	14,228	80,039	—	94,267
8/23	24,694	24,694	29,582	81,830	1,641	113,053
8/30	28,505	28,505	38,551	66,357	—	104,908
9/6	14,583	14,583	24,573	50,097	—	74,670
9/13	19,867	19,867	21,239	79,705	609	101,553
9/20	7,692	7,692	28,235	44,450	2,754	75,439
9/27	9,685	9,685	23,228	24,707	243	48,178
10/4	755	755	22,323	41,561	1,622	65,506
10/11	5,633	5,633	18,582	50,976	6,144	75,702
10/18	8,990	8,990	31,335	79,388	11,805	122,528
10/25	11,877	11,877	19,469	63,600	11,780	94,849
11/1	425	425	19,351	7,667	4,574	31,592
11/8	—	—	14,050	4,826	23,454	42,330
11/15	—	—	8,574	900	4,098	13,572
11/22	—	—	11,380	17,386	11,712	40,478
11/29	—	—	8,935	2,108	—	11,043
12/6	—	—	4,602	3,639	—	8,241
12/13	—	—	998	3,046	—	4,044
Total	249,044	249,044	496,165	1,034,845	86,099	1,617,109

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GEAR: It is not possible from the information we now possess to state what percentage of the New Brunswick catch was taken by weirs, stop seines, or purse seines. During the period January to March the purse seiners catch most of the fish, but during the peak months from June to November only weirs are generally allowed to operate. The herring fishery in New Brunswick is regulated by the government and rather flexible restrictions on the seasonal use of the various gears in different areas are enacted.

SEASON: The catch between January and June was comparatively small. After the first of July greater quantities of herring were taken in both counties. The peak month was September. In June and July Deer Island and Campobello Island were the most important areas. In August Beaver Harbor and Deer Island were very productive with Dipper Harbor and Chance Harbor yielding large quantities of fish in the latter part of August and the first half of September. September and October were the peak months for St. John Harbor and Musquash Harbor weirs. St. Andrews and Big Bay weirs yielded well in October and part of November. Grand Manan had its best catch in November and and the first part of December. Of all the regions Deer Island was perhaps the most consistent producer. The above comments regarding the seasonal trends are based on our observations of fish landed at American canneries.

TABLE 6: Herring and "Sardine" catch for Charlotte and St. John Counties during 1947.

Month	Charlotte County	St. John County	Total
	Pounds	Pounds	Pounds
January	2,247,000	1,200	2,248,200
February	2,564,800	1,000	2,565,800
March	5,577,800	12,700	5,590,500
April	3,379,000	209,000	3,588,000
May	3,557,700	169,000	3,726,700
June	4,756,900	23,000	4,779,900
July	12,409,300	231,000	12,640,300
August	17,864,900	1,060,000	18,924,900
September	19,837,700	3,860,000	23,697,700
October	16,429,100	1,934,500	18,363,600
November	11,080,600	191,000	11,271,600
December	2,179,300	842,600	3,021,900
Total	101,884,100	8,535,000	110,419,100

Information on the following areas V - XVII of the Maine coast is shown in Table 5. Figures 5 - 7 show these areas graphically. Definitions of the areas, enumerations of the gear employed, and the general seasonal trend are discussed as follows:

Area V.

This section has its eastern and northern boundary at Calais, Maine, and its western and southern boundary at Leadurny Point, Lubec. This area includes the "Perry Shore" and the Cobscook Bay - South Bay, Dennys Bay - Whiting Bay sections.

GEAR: In 1947 there were 16 weirs between North Perry and Carlow Island. The total catch of the area was 89,236 bushels, of which the weirs took 88 percent. Stop seiners, fishing in Mill Cove near Robbinston, caught most of the remaining 12 percent.

SEASON: There was no definite peak period during the season. The catches were small during the first of the season, but after the middle of August began to improve. After the first week of November the weirs ceased fishing. The stop seiners were most active after the middle of October. Cobscook Bay, once the scene of an important herring fishery, again was unproductive.

Area VI.

This region has its eastern boundary at Leadurny Point, Lubec, and its western boundary at Cape Wash.

GEAR: Eleven weirs were fishing in Area VI during 1947. Four were located in Little Machias Bay; two at Cutler Harbor; and one each at Moose Cove, Sand Cove, Bailey's Mistake, Boot Cove, and Carrying Place Cove. Several stop seine crews also fished in this area for brief periods during the season and made catches in a few places, including Hamilton Cove and Carrying Place Cove. Of the 192,166 bushels reported from Area VI, 92 percent was credited to weir fishermen and 8 percent to stop seines. This region had the most productive weir fisnery on the Maine coast during 1947.

SEASON: The peak of the weir fishery occurred in the middle of October. The catches were fairly consistent throughout the season which began in the latter part of June and ended in the first week of December. The stop seiners caught herring intermittently with their greatest production being near the end of the season.

Area VII

This region is bounded on the east by Cape Wash and on the west by Wallace Point, Moose Neck, Addison.

GEAR: Thirty-three weirs were in operation in 1947. There were seven in Machias Bay, three in Little Kennebec Bay, nine in Pond Cove, four in the Chandler River, two at Roque Island, five in Eastern Bay, and three between Addison and Jonesport. Weirs caught 44 percent of the 157,498 bushel catch. Stop seiners, most active at Roque Bluffs, Holly Cove, Cross Island and Eastern Bay, took 56 percent of the total production. No purse seiners were active in Area VII during the season June-December. In February and March 1947, purse seiners took 28,500 bushels out of this region, principally from Machias Bay.

SEASON: This area was producing herring up to the end of the canning season in the middle of December. The peak catches occurred between the last half of August and the first half of September. After that period the catches were very erratic. As is true of many places where this gear is fished, some weirs were financially successful, but others failed to pay expenses.

Area VIII

This region has its eastern boundary at Wallace Point, Moose Neck, Addison, and its western boundary at Schoodic Point.

GEAR: Twenty-six weirs were operating in this area in 1947. Three were in Gouldsboro Bay, eight in Dyers Bay, seven in Pigeon Hill Bay, six in Narraguagus Bay, one in Cape Split Harbor, and one in Pleasant Bay. The total catch of herring was 100,767 bushels. The weirs took 74 percent of this total. Stop seines were the other gear used to take 26 percent of the season's production. The stop seiners' catches were made mainly in One Squeak Harbor and Bunkers Harbor. Only two other areas, V and VI, had greater weir catches than Area VIII, but considering the number of weirs operating the average catch was only slightly over 3,000 bushels, which means that on the whole weir fishing was not lucrative in Area VIII.

SEASON: The period between the latter half of July and the latter part of September was the main season for herring in this section. The seine catches were made principally in August. Subsequent to October, the weir catches dwindled and then ceased entirely after the first week of November.

Area IX

This area is bounded on the east by Schoodic Point and on the west by a line running south from Bass Harbor Head, Mount Desert Island. This section includes Frenchman Bay, Somes Sound, Southwest Harbor, and the Cranberry Islands.

GEAR: Five weirs were operating in 1947. On the northern and eastern sides of Mount Desert Island there were two, one at Sands point and one in Somes Sound. There was one at Ingalls Island, Sullivan Harbor, one at Yellow Island, Stave Island Harbor, and one on Little Cranberry Island. Of the total catch of 102,729 bushels weirs accounted for 18 percent, while stop seines caught 82 percent. No purse seines were used. The stop seine catch was made principally at the Cranberry Island. Smaller amounts were caught at Hulls Cove, Salisbury Cove, Bar Harbor and Winter Harbor.

SEASON: The production of herring from the weirs fluctuated from week to week between the first of July and the first week of November when the fishery concluded. The stop seiners made their main catches between the middle of July and the last of September with the peak in the middle of August. A few thousand bushels were taken by seiners during October, but the boats ceased fishing by the first of November.

Area X

This region has as its eastern boundary a line running south from Bass Harbor Head, Mount Desert Island, to Long Island Head. Its southern boundary is a line running in a northwestwardly direction from Great Spoon Island to Naskeag Point. Area X thus includes Blue Hill Bay, Swans Island, Marshall Island and Long Island.

GEAR: Fourteen weirs were fishing in this region in 1947. There were six on Swans Island, three on Long Island, (off Blue Hill), two at Flye Point, one at Blue Hill Falls and two near Tremont, Mount Desert Island. The weirs caught less than 9 percent of the total production of 203,617 bushels. Stop seines were the dominant gear in Area X, for 185,641 bushels were taken with that apparatus. Most of the stop seine catch came from Marshall Island, with a smaller amount taken at Long Island (Frenchboro). While the weir fishery was relatively poor, the seiners made remarkable catches in this area, and as a result this region was second in production only to Area XVII.

SEASON: The weir fishery reached its peak in the latter half of July and then declined to weekly landings of less than 1,000 bushels (except for the week ending September 6). By the middle of October

the weir season was over. No purse seines operated in this area. The stop seine boats began catching herring in the latter half of July and made good catches up to the last of October when fishing ceased. September was the peak month for the seiners.

Area XI

This area has its western boundary in a line running in a southwestwardly direction from Cape Rosier to the south end of Lasell Island, thence eastward to Bald Island and southward to Saddleback Ledge. Its southern boundary is marked by a line running southeastwardly from Saddleback Ledge to Roaring Bull Ledge. Its eastern boundary is a line running northeastwardly from Roaring Bull Ledge to Great Spoon Island and thence northwardly to Naskeag Point. Area XI includes Eggemoggin Beach, Little Deer Isle, Deer Isle, Isle au Haut and a multitude of small islands.

GEAR: Fourteen weirs were fishing in this area in 1947. There was one on Isle au Haut, two at West Stonington, two at Sunset, Deer Isle, two at Oak Point, Deer Isle, and seven near Sunshine, Deer Isle. Of the total catch of 32,923 bushels, stop seines caught 7 percent; the remainder was taken from the weirs.

SEASON: The last half of June marked the beginning of the fishery and the season ended in the first week of October. The catch fluctuated markedly with peaks in the latter parts of July, August, and September. Considering the number of weirs operating, the season probably was not a financial success to the weir fishermen.

Area XII

This area lies north of a line running in an eastwardly direction from Northeast Point, Camden, to the southern end of Lasell Island. Its western boundary is a line running from the southern end of Lasell Island to Cape Rosier. This region is the upper part of West Penobscot Bay, including Seven Hundred Acre Island and Long Island.

GEAR: In 1947 a total of six herring weirs was in operation. Two were located near Searsport; two at Northport; and one each at Islesboro and Lincolnville Beach. Stop seines or purse seines were not used in this region, consequently the catch of 19,345 bushels was taken entirely by weirs.

SEASON: The first lots of herring were caught in the first week of July and the fishery reached its peak during the last half of that month. After the first week in August, the weekly catch up through the first half of October when the fishery ended was less than 1,000 bushels. On the whole, the fishery in this region was not successful in 1947.

Area XIII

This region is bounded on the north by a line running eastwardly from Northeast Point, Camden to the southern end of Lasell Island, thence to Bald Island. The eastern and southern boundaries are lines running in a southern direction from Bald Island to Saddleback Ledge, thence westward to Bay Ledge. The western boundary is a line from Bay Ledge to Owls Head. The principal fishing areas in this section are Camden Harbor, Rockport Harbor and the many bays around the islands of Vinalhaven and North Haven.

GEAR: There were two herring weirs actively fishing in Area XIII during 1947. One was on Vinalhaven Island and the other on North Haven Island. Of the 43,466 bushels caught during the season weirs took 17 percent and stop seines 83 percent. No purse seines were used.

SEASON: The catch of 1947 was probably less than the average for this region. The season began in the latter part of June and ended in the last half of September, except for a few hundred bushels taken in October.

Area XIV

This is an area bounded on the northeast by a line from Owls Head to Bay Ledge and on the southwest by Marshall Point, Port Clyde. This section contains Metinic Island, Matinicus Island and the smaller islands near it, and Muscle Ridge Channel, which includes Tenants Harbor, Martinsville and others.

GEAR: Four herring weirs were in operation in this area during the 1947 season. All were located in the Muscle Ridge Channel region. The weirs could not be considered as successful, for our records show a total weir catch of less than 4,000 bushels. Undoubtedly some weir herring was sold for lobster bait, but probably not any great quantity.

Stop seines caught 86 percent of the total of 63,703 bushels while purse seiners operating between Monhegan Island and Matinicus Island caught slightly less than 8 percent.

SEASON: Our records indicate that the first quantities of herring were taken in the latter part of June and the catches, in general, remained relatively small throughout the season until its conclusion in the last of October. Several fair weeks occurred during August.

Area XV

This is a region bounded on the east by Marshall Point, Port Clyde and on the west by Pemaquid Point Light. This area includes Muscongus Bay in which are located Friendship Island, Cranberry Island, McGee Island, Muscongus (Louds) Island, Long Cove, and New Harbor, all localities where the herring fishing was profitably conducted. Also in Area XV is Monhegan Island around which large herring congregate during the fall.

GEAR: There are no weirs in this area. The fishery for the small herring is carried on by stop seiners, while large herring are caught by purse seiners. Of the 183,986 bushels caught during 1947, stop seines accounted for 76 percent and purse seines for 24 percent.

SEASON: The fishing in this area was erratic during the period June through September. Few large catches of fish were made until October. The four weeks of good fishing in October made the herring fishery a success in this area, which supplies the canneries of both the Portland and Rockland districts. Purse seiners landed small catches of large herring taken in this area between June and the middle of September. These minor amounts were caught then by boats fishing mainly for mackerel. During October these boats, together with other boats ordinarily employing stop seines but converted to purse seining, began fishing for the large herring near Monhegan Island. Some of the catches of large herring credited to Area XV may have been taken in Area XVI, as will be explained later. Purse seining was concluded by the first week of November while small quantities of fish were taken by stop seiners until the end of that month.

Area XVI

This is bounded on the east by Pemaquid Point Light and on the west by Small Point. It includes Johns Bay, Damariscotta River, Linekin Bay, Boothbay Harbor and Sheepscot Bay. The Damariscove Island - Heron Island - Pumpkin Island region off Boothbay Harbor is also a part of Area XVI.

GEAR: Although the Sheepscot Bay section once had a productive weir fishery, particularly along Westport Island, there was only one small weir in all of Area XVI in 1947. Records of the catch of this weir located at Hodgdon's Island, near Barter Island, are not available, but probably not more than a few hundred bushels were caught during 1947. The stop seine is the principal gear in this area. Of the total production of 177,004 bushels in 1947, stop seines caught 79 percent. Purse seines accounted for 21 percent. The Damariscove Island, Heron Island, Pumpkin Island region is one of the two principal areas where purse seines are used to capture large herring.

SEASON: The stop seine fishery reached its peak in this area in the first half of July. Between the middle of August and the first week of October, there was little activity. In that period most of the stop seiners moved to Area XVII where large quantities of fish were available. The stop seine catch in Area XVI had a marked upswing for several weeks in October, but by the end of that month this fishery was, to all practical purposes, concluded.

The purse seine fishery was, in comparison to other years, quite successful because of the increased demand for the fish. The first three weeks of November were the most productive. As mentioned in the discussion of Area XV, it has been difficult to assign a definite locale to all the purse seine catches. Under the present area system the herring concentrated between Monhegan Island and the islands off Boothbay Harbor may be placed in either Area XV or XVI depending upon which section is stated by the sardine boat operators or seine crew to be the place of capture. Perhaps it would be better to consider this entire offshore region as a distinct area. In that case the peak of the season for large herring could be located as between the middle of October and the last of November.

Area XVII

This section is bounded on the east by Small Point and on the west by the west end of Richmond Island. It includes all of Casco Bay. The most productive fishing locality in this region was the Cliff Island (Crotch Island) - Jewell Island - Bates Island complex. Other bodies of herring were caught in lesser quantities in other sections including Small Point Harbor, Bailey Island, Haskell Island, Potts Harbor, Chandler Cove, Green Island, and Great Diamond Island.

GEAR: This is an area in which the 1947 catch was taken almost entirely by stop seines. There are several fish traps in this region, principally at Small Point and Cape Elizabeth, but their catches are primarily mackerel and whiting. We have no records of the herring production by these traps, but believe that only a few hundred bushels were caught. For the 1948 season a herring weir has been erected at Prince Point, just north of Portland.

SEASON: The middle of July marked the start of the big run of fish which made Area XVII the most important producer of herring on the Maine coast. A total catch of 249,044 bushels was caught up to the first week of November when fishing ceased. The peak of the season was from the middle of July to the middle of September. The large bodies of herring in Casco Bay attracted stop seiners usually fishing in Areas XV and XVI and the resulting catches were sufficient to keep the canneries in the Portland district supplied with an abundance of fish for most of the canning season.

The region to the west of Area XVII.

The herring fishery is not now carried on along the Maine coast west of Cape Elizabeth. The coast there, as a whole, is not indented or protected enough to make stop seining feasible during most of the season. While the area around Wood Island was for many years the scene of productive gill net fishery for large herring in the fall, no attempt is now made there to catch the mature fish. It is not known whether or not the herring schools still appear near Wood Island. Undoubtedly, schools of herring are common along the coast of York County and perhaps purse seines could be employed to catch them. However, as long as a plentiful supply of herring exists on the grounds east of Cape Elizabeth, there is no reason to expect an extension of the fishery to the westward of that point. Any scarcity of herring on the usual fishing grounds could, of course, stimulate exploratory fishing expeditions to this unexploited and perhaps productive area.

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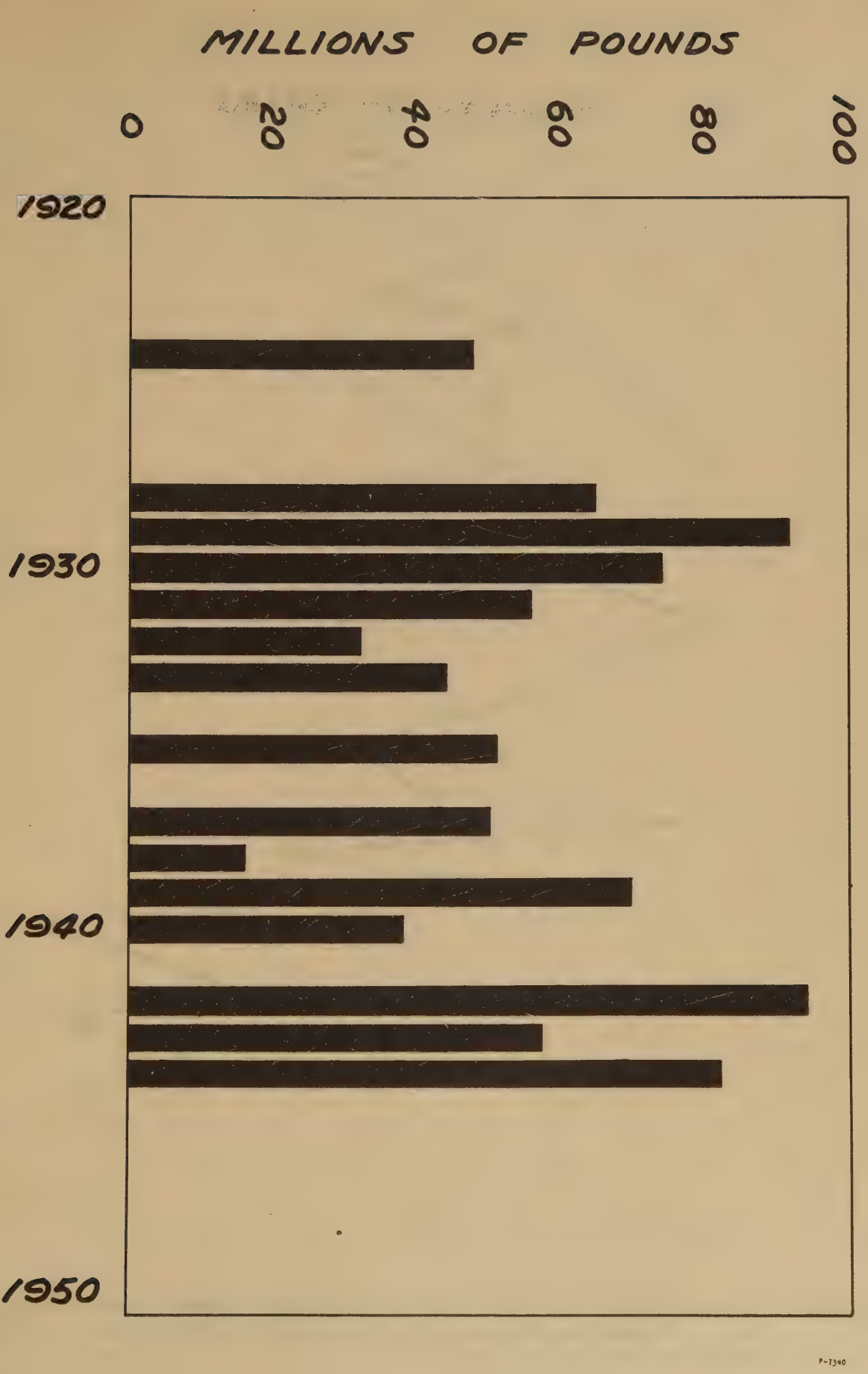

Figure 1. Annual production of Maine herring during the years when statistics were collected by the U. S. Bureau of Fisheries and U. S. Fish and Wildlife Service between 1920 and 1944.

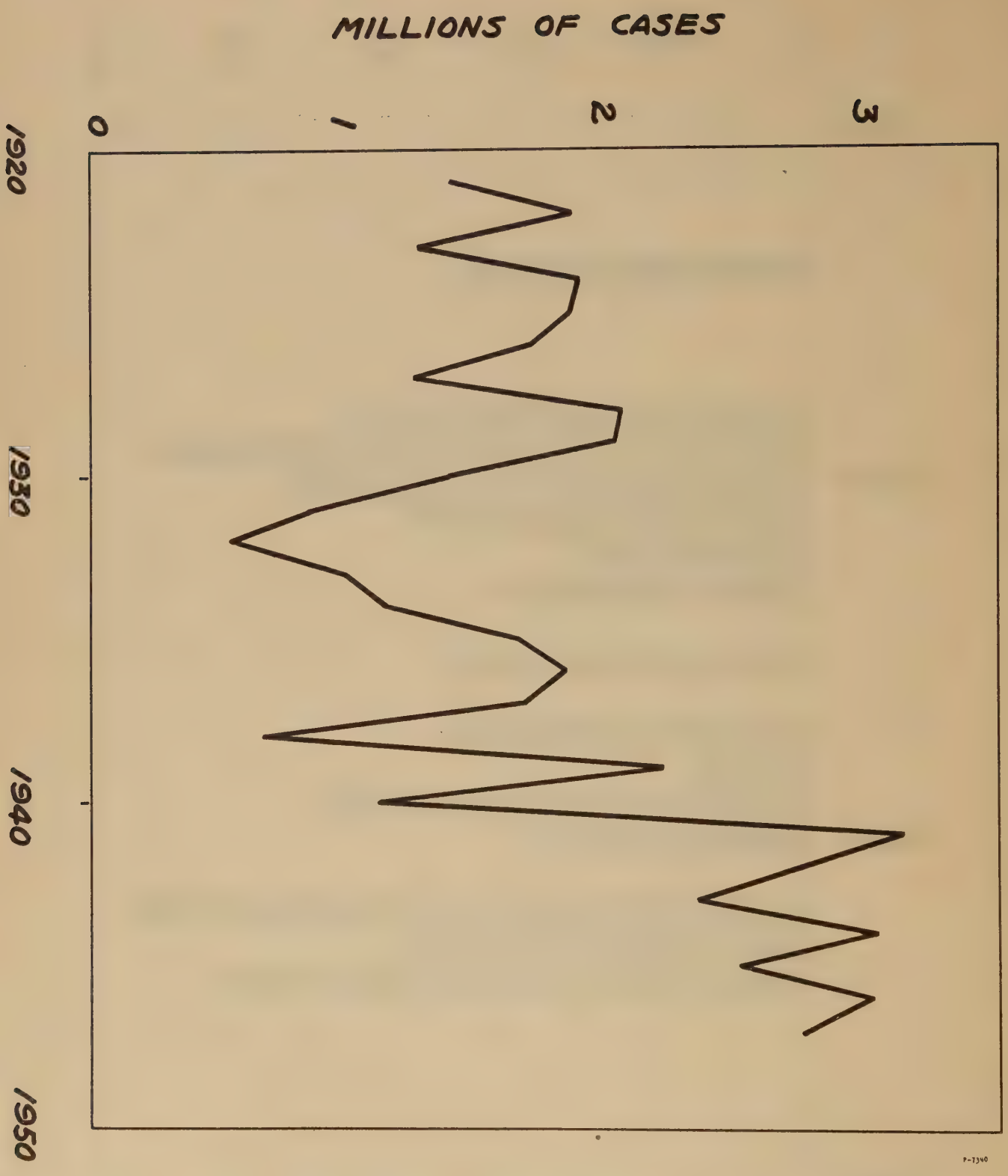

Figure 2. Pack of canned sardines (Atlantic herring) between 1928 and 1947, from data obtained by the U. S. Bureau of Fisheries and U. S. Fish and Wildlife Service.

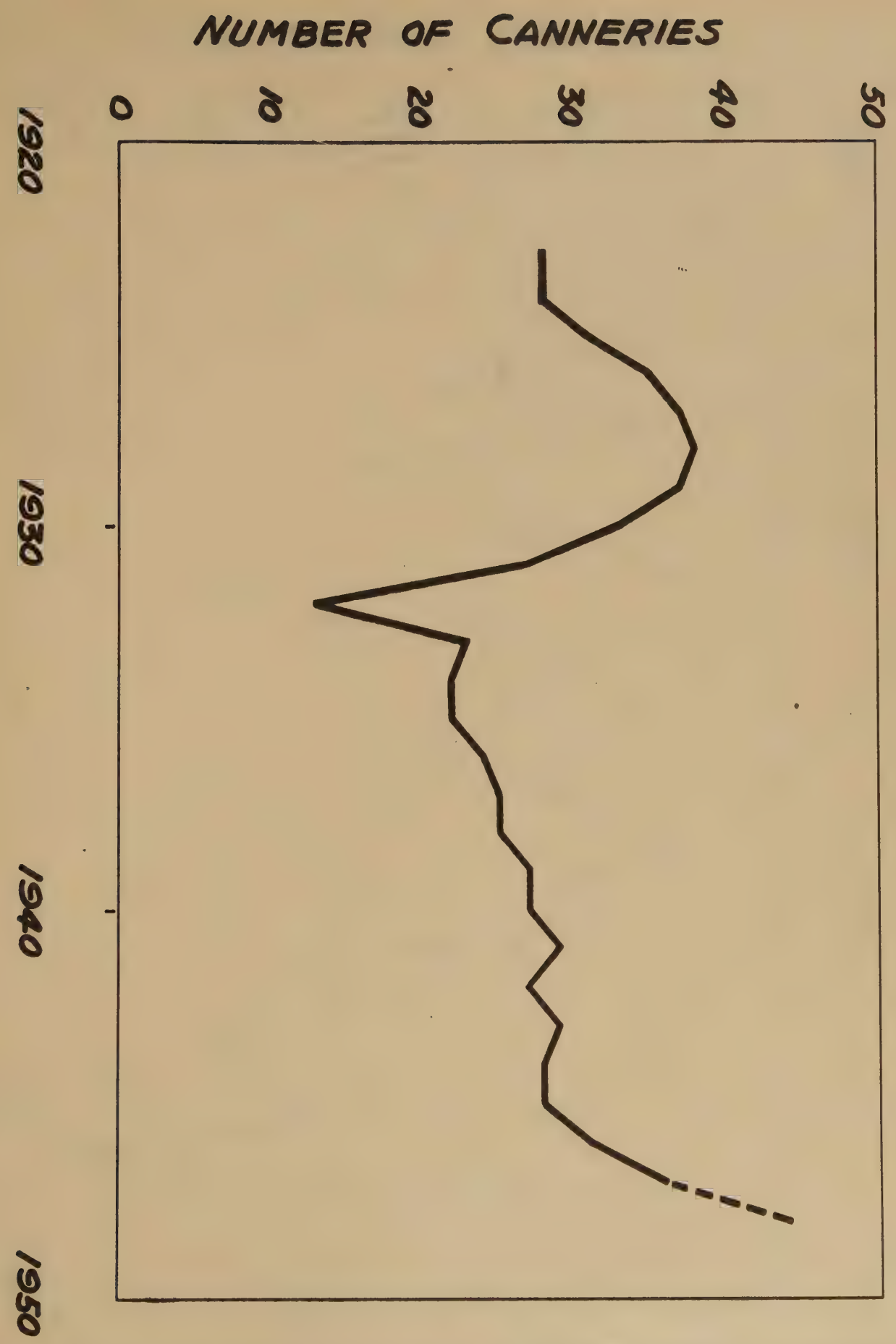

Figure 3. Number of active sardine plants in the North Atlantic United States from data obtained by the U. S. Bureau of Fisheries and U. S. Fish and Wildlife Service.

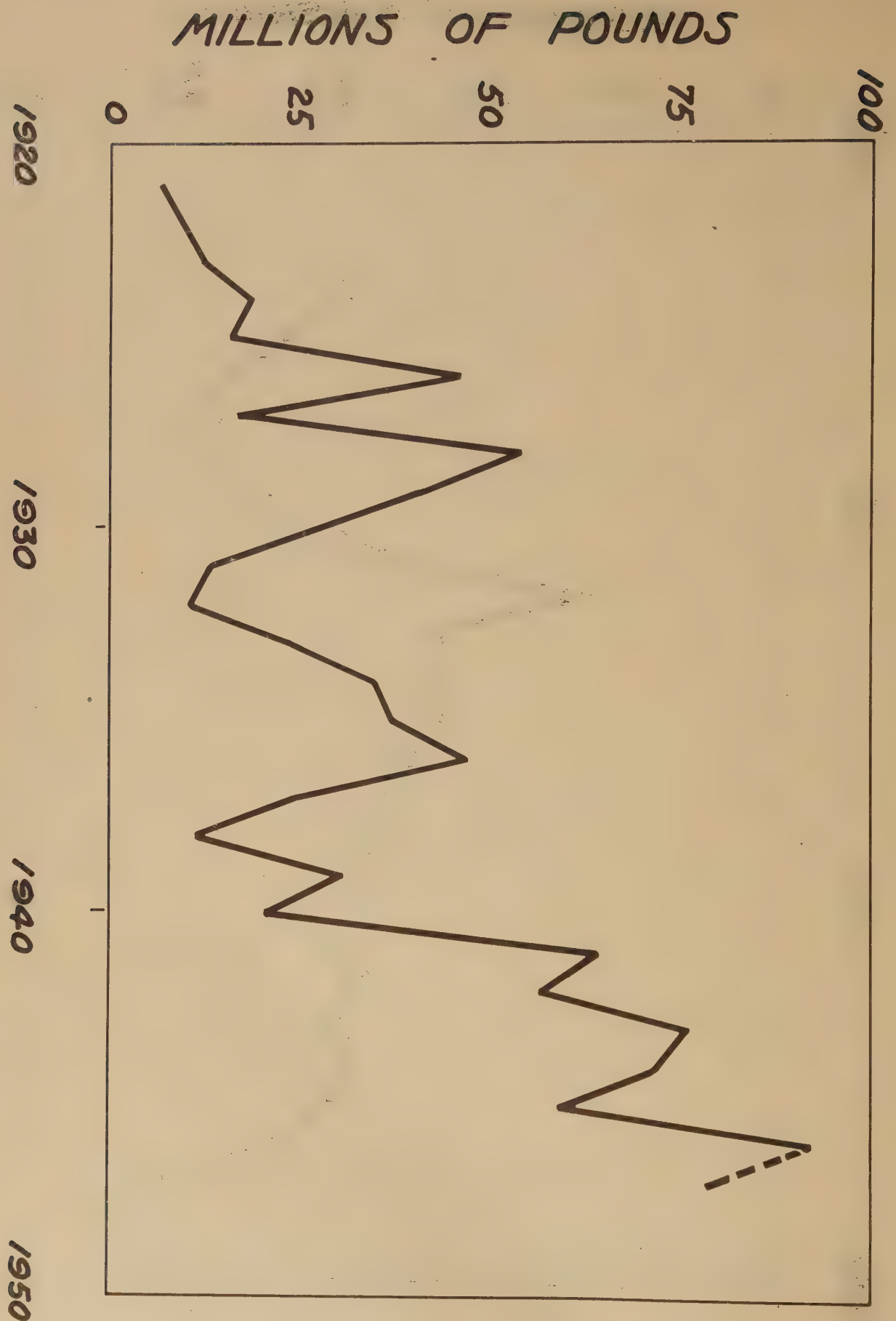

Figure 4. Imports of fresh sea herring between 1921 and 1947, from data collected by the U. S. Bureau of Fisheries and U. S. Fish and Wildlife Service from the U. S. Bureau of Customs.

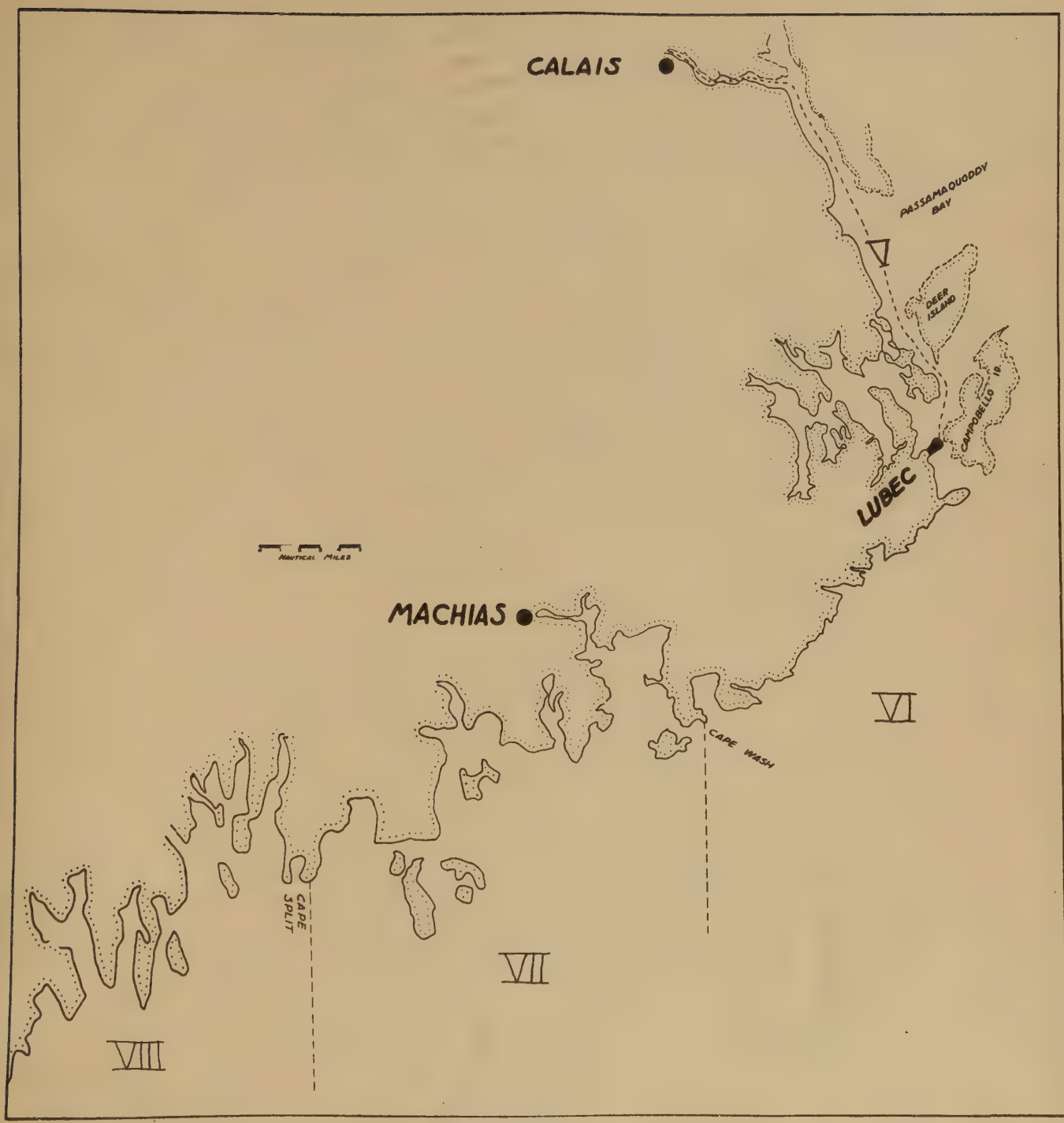

Figure 5. Maine herring areas V to VIII.

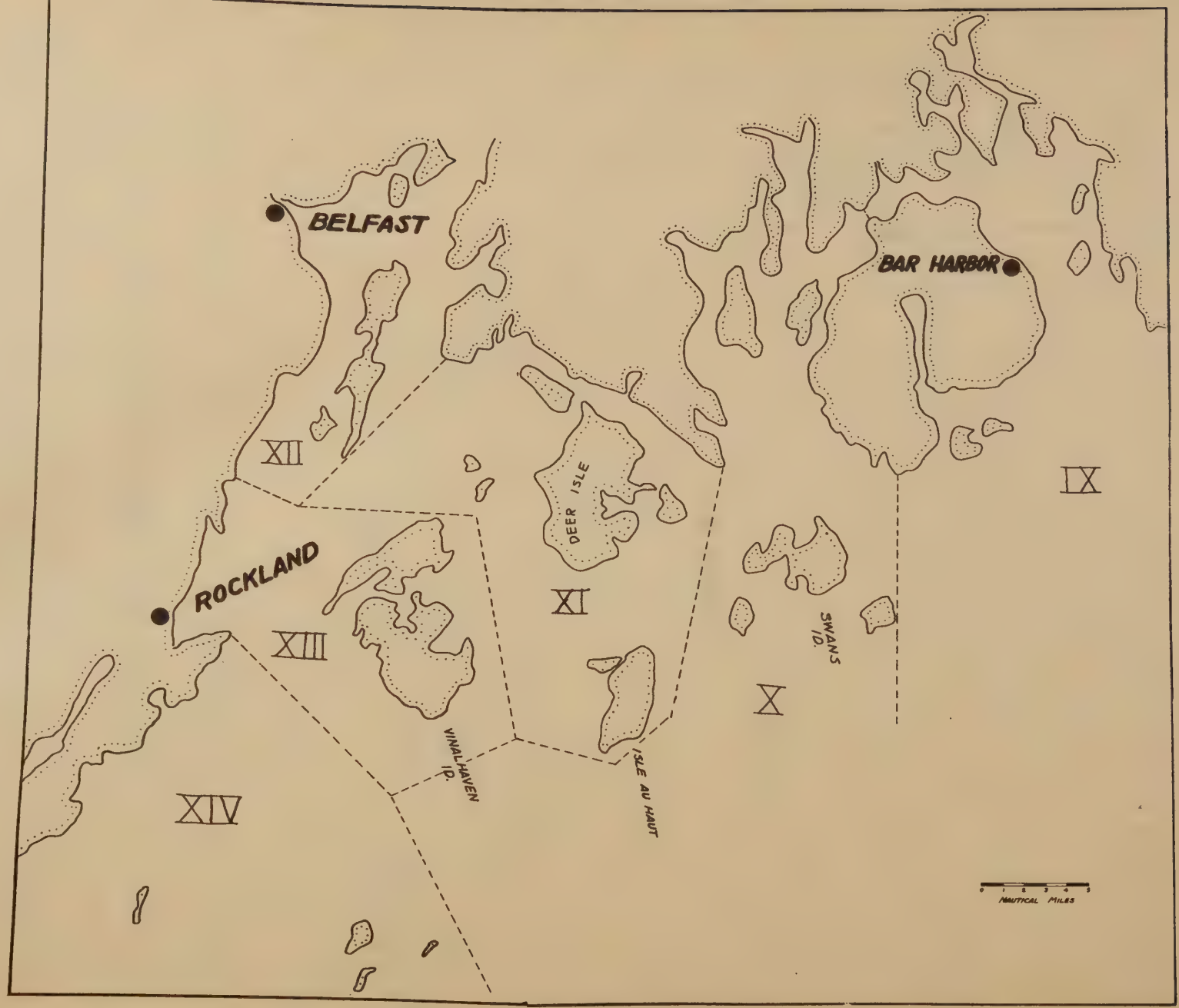

Figure 6. Maine herring areas IX to XIV.

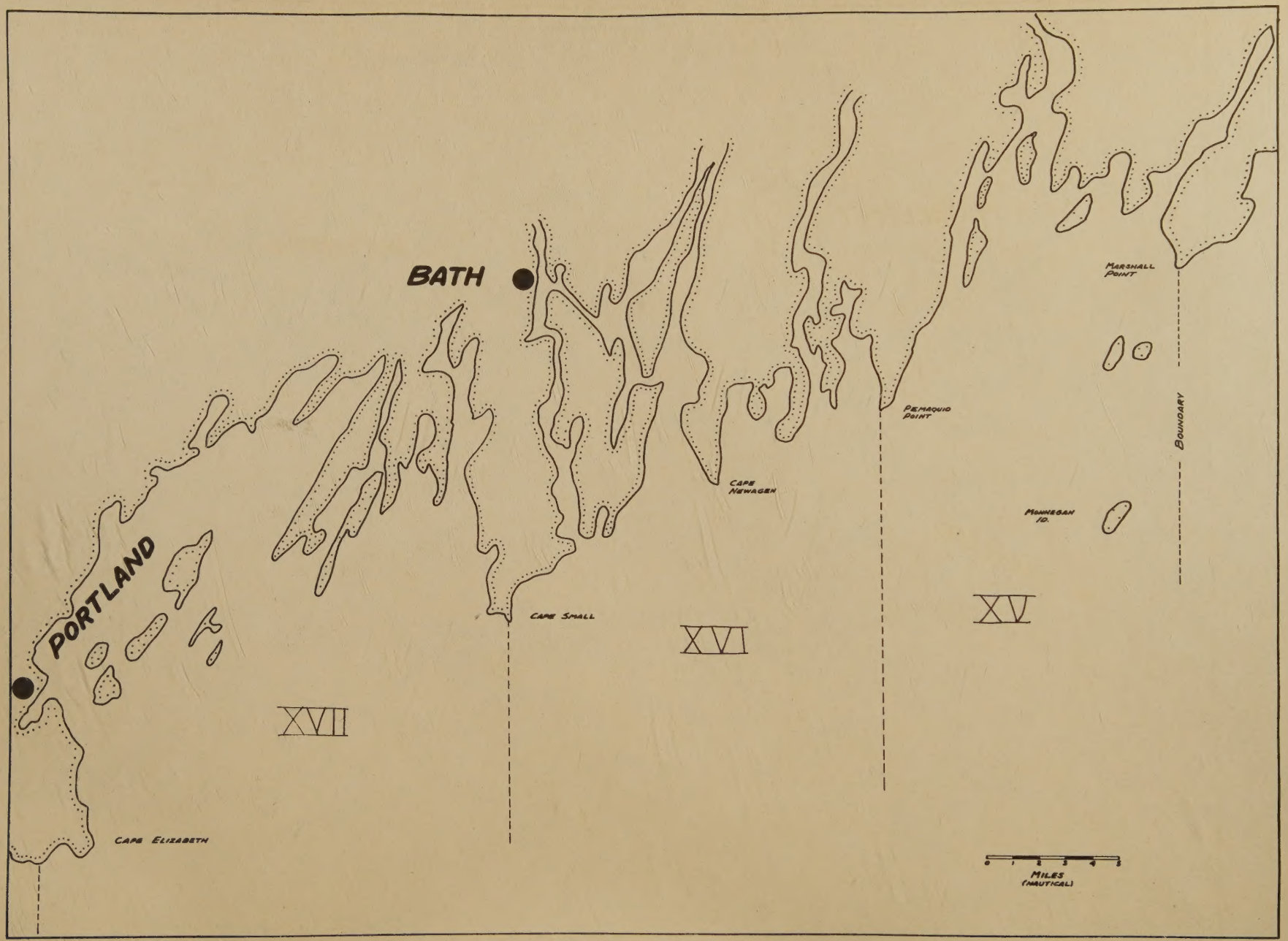

Figure 7. Maine herring areas XV to XVII.